CLAIMS

What is claimed is:

1. A mold component configured for use with a base mold in a closed molding process to form a fiber reinforced composite part, the mold component comprising:

a flexible body structure including a perimeter region and an interfacing surface, at least a portion of the interfacing surface configured to contact the part disposed on the base mold, and the flexible body structure having integrally formed therewith:

one or more distribution channels extending across the interfacing surface; and

one or more perimeter seals extending from the perimeter region for sealing engagement with the base mold to enclose the part between the body structure and the base mold.

2. The mold component of claim 1, wherein the one or more perimeter seals comprise a plurality of perimeter seals extending downward from the body structure and defining a vacuum distribution channel therebetween.

3. The mold component of claim 1, wherein the one or more distribution channels comprise:

one or more resin distribution channels; and

one or more vacuum distribution channels.

4. The mold component of claim 3, further comprising:

a standoff extending from the interfacing surface of the body structure; and

a plurality of passages formed in the standoff to facilitate fluid communication between the one or more resin distribution channels and an enclosed space formed between the body structure and the base mold where the fiber reinforced composite part may be formed.

5. The mold component of claim 1, wherein the flexible body structure is formed of one or more material selected from the group consisting of polyurea, polyurethane and a polyurea/polyurethane compound.

6. The mold component of claim 5, wherein the flexible body structure is further formed as one of an aliphatic, aromatic or polyaspartic compound.

7. The mold component of claim 1, wherein the one or more perimeter seals comprise a grid of sidewall flanges.

8. The mold component of claim 1, wherein the body structure further comprises first regions formed at the one or more distribution channels having increased rigidity as compared to the remainder of the body structure.

9. The mold component of claim 8, wherein the first regions include a reinforcing material bonded with the body structure.

10. The mold component of claim 1, wherein the composite part requires varying mold surface conformities and molding pressures for its formation, and wherein the body structure is formed of one or more materials having varying physical properties so that the physical properties of the body structure correspond to the physical properties required for the formation of the composite part.

11. The mold component of claim 10, wherein physical properties include one or more of the following: density, rigidity, compression and elongation.

12. The mold component of claim 1, further comprising:

one or more resin input ports extending through the body structure and in fluid communication with at least one of the one or more resin distribution channels; and

one or more vacuum output ports extending through the body structure and in fluid communication with at least one of the one or more vacuum distribution channels.

13. A mold component configured for use with a base mold in a closed molding process to form a fiber reinforced composite part, the mold component comprising:

a flexible unitary body having one or more perimeter seals and an interfacing surface upon which one or more distribution channels are formed;

wherein the unitary body is formed substantially of one or more materials selected from the group consisting of polyurea, polyurethane and a polyurea/polyurethane compound.

14. The mold component of claim 13, wherein the one or more perimeter seals comprise a plurality of perimeter seals extending downward from the unitary body and defining a vacuum distribution channel therebetween.

15. The mold component of claim 13, wherein the one or more distribution channels comprise:

one or more resin distribution channels; and

one or more vacuum distribution channels.

16. The mold component of claim 15, wherein at least a portion of the interfacing surface is configured to contact the part disposed on the base mold, the mold component further comprising:

a standoff extending from the interfacing surface of the unitary body; and

a plurality of passages formed in the standoff to facilitate fluid communication between the one or more resin distribution channels and an enclosed space formed between the unitary body and the base mold where the fiber reinforced composite part may be formed.

17. The mold component of claim 13, wherein the unitary body is further formed as one of an aliphatic, aromatic or polyaspartic compound.

18. The mold component of claim 13, wherein the one or more perimeter seals comprises a grid of sidewall flanges..

19. The mold component of claim 13, wherein the unitary body further comprises first regions formed at the one or more distribution channels having increased rigidity as compared to the remainder of the body structure.

20. The mold component of claim 19, wherein the first regions include a reinforcing material bonded with the unitary body.

21. The mold component of claim 13, wherein the composite part requires varying mold surface conformities and molding pressures for its formation, and wherein the material forming the unitary body has varying physical properties so that the physical properties of the unitary body correspond to the physical properties required for the formation of the composite part.

22. The mold component of claim 21, wherein physical properties include one or more of the following: density, rigidity, compression and elongation.

23. The mold component of claim 13, further comprising:

one or more resin input ports extending through the unitary body and in fluid communication with at least one of the one or more resin distribution channels; and

one or more vacuum output ports extending through the unitary body and in fluid communication with at least one of the one or more vacuum distribution channels.

24. In a closed molding system for forming a fiber reinforced composite part, the system including an A surface mold tool and a B surface mold tool, the improvement comprising:

the B surface mold tool comprising a flexible body structure including a perimeter region and an interfacing surface, at least a portion of the interfacing surface configured to contact the part disposed on the base mold, and the flexible body structure having integrally formed therewith:

one or more distribution channels extending across the interfacing surface; and

one or more perimeter seals extending from the perimeter region for sealing engagement with the base mold to enclose the part between the body structure and the base mold.

25. The system of claim 24, wherein the one or more distribution channels comprise:

one or more resin distribution channels; and

one or more vacuum distribution channels.

26. The system of claim 25, further comprising:

a standoff extending from the interfacing surface of the body structure; and

a plurality of passages formed in the standoff to facilitate fluid communication between the one or more resin distribution channels and an enclosed space formed between the body structure and the base mold where the fiber reinforced composite part may be formed.

27. The system of claim 24, wherein the flexible body structure is formed of a material selected from the group consisting of polyurea, polyurethane and a polyurea/polyurethane compound.

28. The system of claim 24, wherein the B surface mold tool requires varying mold surface conformities and molding pressures for its formation, and wherein the body structure is formed of one or more materials having varying physical properties so that the physical properties of the body structure correspond to the physical properties required for the formation of the composite part.

29. The system of claim 28, wherein physical properties include one or more of the following: density, rigidity, compression and elongation.

30. The system of claim 28, further comprising:

one or more resin input ports extending through the unitary body and in fluid communication with at least one of the one or more resin distribution channels; and

one or more vacuum output ports extending through the unitary body and in fluid communication with at least one of the one or more vacuum distribution channels.

31. A process involving closed molding tooling techniques to form a fiber reinforced composite part against a base mold with a flexible body structure having an interfacing surface upon which one or more distribution channels are formed, and one or more perimeter seals, the process comprising:

placing a fiber lay up on the base mold;

moving the body structure onto the base mold such that the fiber lay up is covered by the interfacing surface of the body, thereby forming an enclosed space between the body structure and the base mold, the fiber lay up being located in the enclosed space; and

dispensing resin into the enclosed space and drawing a vacuum through the enclosed space to cause the one or more perimeter seals to sealingly engage the base mold, the interfacing surface of the unitary body to urge the fiber lay up to be shaped to the base mold, and the resin to travel through the one or more distribution channels and across and through the fiber lay up generally in the direction of the vacuum draw to thereby form the composite part upon curing.

32. The process of claim 31, wherein the body structure is formed substantially of a material selected from the group consisting of polyurea, polyurethane and a polyurea/polyurethane compound.

33. The process of claim 31, wherein the one or more perimeter seals comprise a plurality of perimeter seals extending downward from the body structure and defining a vacuum distribution channel therebetween.

34. The process of claim 31, wherein the one or more distribution channels comprise:

one or more resin distribution channels; and

one or more vacuum distribution channels.

35. The process of claim 34, further comprising:

a standoff extending from the interfacing surface of the body structure; and

a plurality of passages formed in the standoff to facilitate fluid communication between the one or more resin distribution channels and the enclosed space.

36. The process of claim 31, wherein the body structure further comprises first regions formed at the one or more distribution channels having varying physical properties as compared to the remainder of the body structure.

37. The process of claim 36, wherein the varying physical properties include one or more of the following: density, rigidity, compression and elongation.

38. The process of claim 36, wherein the first regions include a reinforcing material bonded with the body structure.

39. The process of claim 31, wherein resin is dispensed into the enclosed space through one or more resin input ports extending through the body structure, the vacuum is drawn through the enclosed space through one or more vacuum output ports extending through the body structure..

40. A process involving closed molding tooling techniques to form a fiber reinforced composite part against a base mold with a flexible body structure having an interfacing surface upon which one or more distribution channels are formed, and one or more perimeter seals, the process comprising:

placing a fiber lay up on the base mold;

applying resin onto the fiber lay up;

moving the unitary body onto the base mold such that the fiber lay up/resin combination is covered by the interfacing surface of the body structure; and

drawing a vacuum through the enclosed space to cause the one or more perimeter seals to sealingly engage the base mold, the interfacing surface of the unitary body to urge the fiber lay up to be shaped to the base mold, and the resin to travel through the one or more distribution channels and across and through the fiber lay up generally in the direction of the vacuum draw to thereby form the composite part upon curing.